Name: _____

Period: _____

Levers, Pulleys, Gears, and Incline Planes

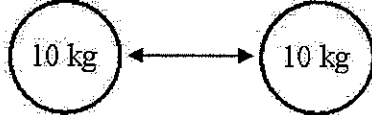**Gravity**   Gravity is a force that pulls any two masses towards each other. Nothing can stop gravity.

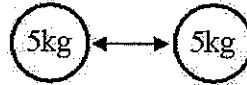Gravity increases with mass.
Less mass: less gravity

5kg ←→ 5kg

Heavier things have more gravitational force (weight) because they have more mass.

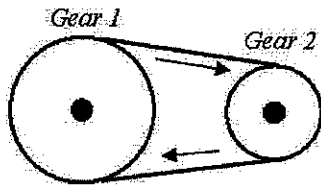Gravity decreases with distance.
Less distance: more gravity

5kg ←→ 5kg

More mass: more gravity

10 kg ←→ 10 kg

More distance: less gravity

5kg ←→ 5kg

As a spaceship gets closer to a planet, the gravity between the planet and the ship gets stronger.

Gears   Gears increase or decrease force or speed thru difference of gear size.

Gear 1   Gear 2

Gear 1   Gear 2

Front   Rear

If gear 1 is bigger, gear 2 turns faster, but gear 1 takes more force. Bicycle gears work like this when on flat roads, when they need more speed, not force.
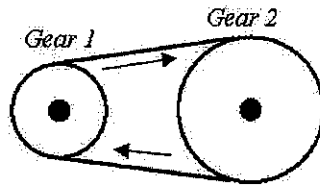
If gear 1 is smaller, gear 2 turns slower, but gear 2 takes less force. Bicycle gears work like this when on hills when a mechanical advantage is needed.
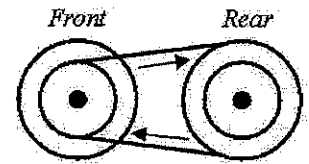
Multi-speed bikes have multiple gears, so you can choose the right combination for the right conditions.

Friction   Friction is a force that opposes moving objects and occurs any time objects touch. Friction causes heat and takes energy away from moving objects and machines.

→ M   *friction* ↘

The object and the table heat up as the two object rub against each other.

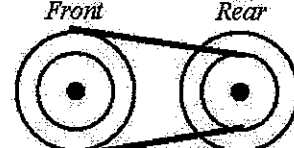**Rough surfaces have** more friction than smooth surface.

An object must be touching something to have friction.

Air friction (air resistance) occurs when objects move thru air. Air friction increases with speed.

Friction can be helpful. A car use the friction of its tires to turn corners.

What is gravity? force pulling any 2 masses together.

Does gravity increase or decrease?
__I__ If you increase the mass of one of the objects?
__I__ If you decrease the distance between the two objects?
__D__ If you decrease one of the masses?
__D__ If the objects are farther apart?

If an object is not touching a table is there friction between them? No

What is another name for air friction? air resistance

Friction always causes what? heat + takes E

Give an example of good friction.
traction + braking + parachutes

Give an example of bad friction.
engine wear, dragging an object

Connect the gears to make the rear gears move fastest.

Front   Rear

Connect the gears to make it easy to go up a hill.

Front   Rear

Balanced or unbalanced forces?

_U_ 10 N left and 5 N right?   _B_ If a = 0?

_U_ An object accelerating?   _B_ If $\Delta v = 0$?

_B_ An object at constant speed?   _U_ When an object turns a corner?

_B_ An object at rest? $v = 0$

Balanced or unbalanced forces?
Calculate the net force and acceleration of the object.

neg   pos
10N   31N   **3kg**

$\Sigma F = F_1 + F_2 = ma$
$= 3 - 10$
$21N = 3(a)$ $a = \frac{21}{3} = 7 \ m/s^2$

Which falls faster: heavy or light objects?
Why? only if air friction. If no air friction they fall same.

Will it accelerate faster or slower?
_S_ If you increase an object's mass.
_F_ If you increase the force on the object.

How do simple machines multiply force?
By increasing distance.

Using a simple machine do you use more or less energy (and why)? Friction. (But you use less force.)

Input Force (F_{in}) or Output Force (F_{out})?

_I_ How far you push from the fulcrum. De

_O_ How heavy the object is.

_O_ How hard the pulley pulls on the object.

_I_ How much force you push up a ramp.

Distance of Effort (D_E) or Distance of Resistance (D_R)?

_E_ How far you apply your force from the fulcrum. input

_R_ How high you lift the object.

_R_ How far the pulley lifts the object.

_R_ How far the object is from the fulcrum.

A.   B.   C.

Fin

60N 40N De

120 N 120 N Fout 120N 120 N DR
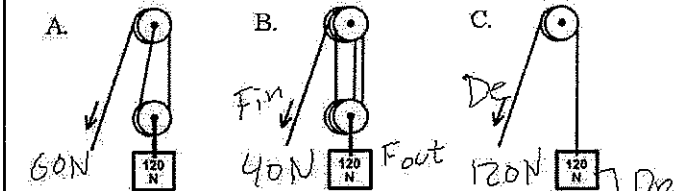
Label F_{in}, F_{out} on diagram B.
Label D_E and D_R on diagram C.
Which has three support ropes? B
Which has the greatest output force? same
Which needs the smallest input force? B
Which has the greatest MA? B
Find F_{in} for each.

Which has more inertia: only changes w/ mass
A 50 kg object or a 10 kg object?
A 30 kg object on the earth or in space? same
A 20 kg object going 50 m/s, or a 30 kg object at rest.

What is the difference between mass and weight?
mass is atoms + molecules
weight - gravity pulling on mass.

Which changes in space? weight (no gravity)

Mass or Weight: _W_ 20 N; _m_ 30 kg?

A 4 kg object accelerates 12 m/s^2 to the left, find the force on it.
$m = 4 kg$ $F = ma$
$a = -12 \ m/s^2$ $= 4(-12) = -48 N$
$F = \_\_$
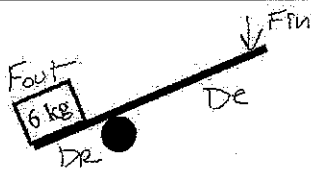
A 30 N net force pulls to the right on a 5 kg object. Find its acceleration.
$F = 30 N$ $F = ma$ $a = 6 \ m/s^2$
$m = 5 kg$ $30 = 5 a$
$a = \_\_$

Calculate the weight of a 12 kg object.
$12(10) = 120 N$

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1. Experimental variables E	A. Variables that don't change in an experiment.
2. Control Setup C	B. A list of how you perform an experiment.
3. Control variable A	C. An experimental setup without the variable you are studying.
4. Procedures B	D. How many variables you change in a good experiment.
5. One D	E. The variable that you change in an experiment.

Why is a control setup so important?
To see if what you are studying has an effect at all.

Label F_{in}, F_{out}, D_E, and D_R.
What do we call the circle?
fulcrum

Fin
Fout
6 kg   De
DR

Calculate F_{out}? 60 N

Which is bigger F_{in} or F_{out}?

To make it easier, which side should be longer, left or right?

Label F_{in}, F_{out}, D_E, and D_R.

Calculate is F_{out}? 80 N

Fout
Fin
DR   De   80N

Which is bigger F_{in} or F_{out}?

To make F_{in} easier what would you do? longer ramp